

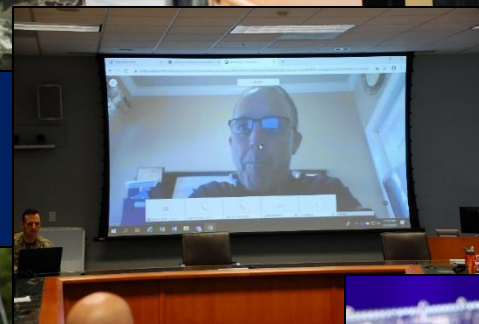
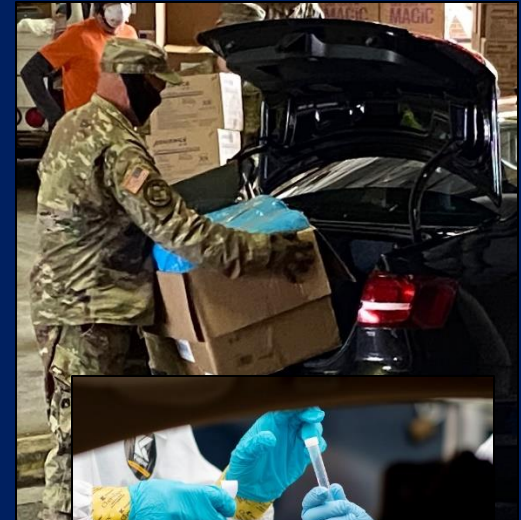


NCEM: Review of 2020

KATIE WEBSTER | ASSISTANT DIRECTOR
Katie.Webster@ncdps.gov



COVID-19 PANDEMIC



FEBRUARY 2020 WINTER WEATHER

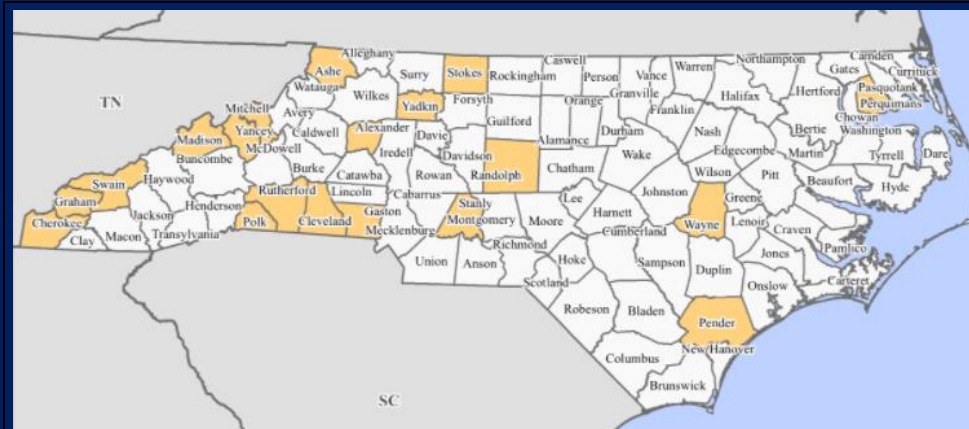


FEBRUARY 2020 SEVERE WEATHER

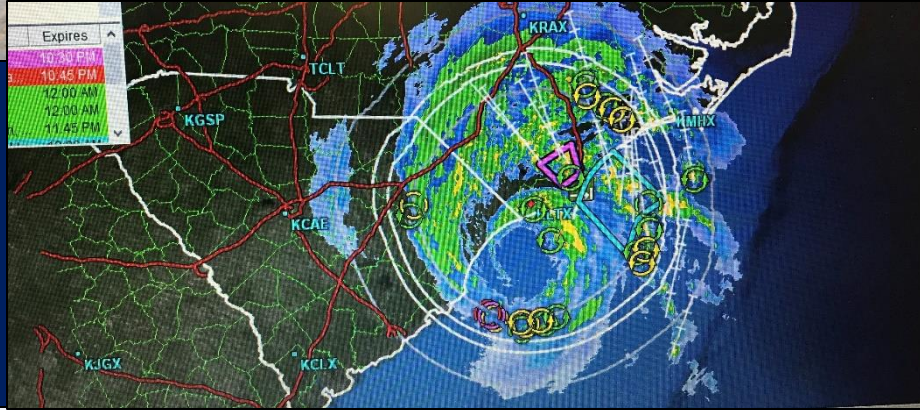
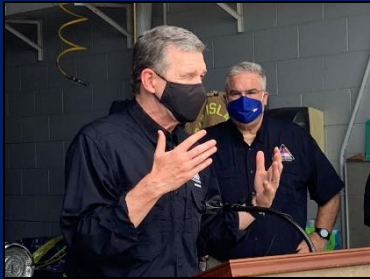


DR-4543
Public Assistance
for 19 Counties

NFIP Claims Paid:
\$1 million+



AUGUST 2020 - HURRICANE ISAIAS

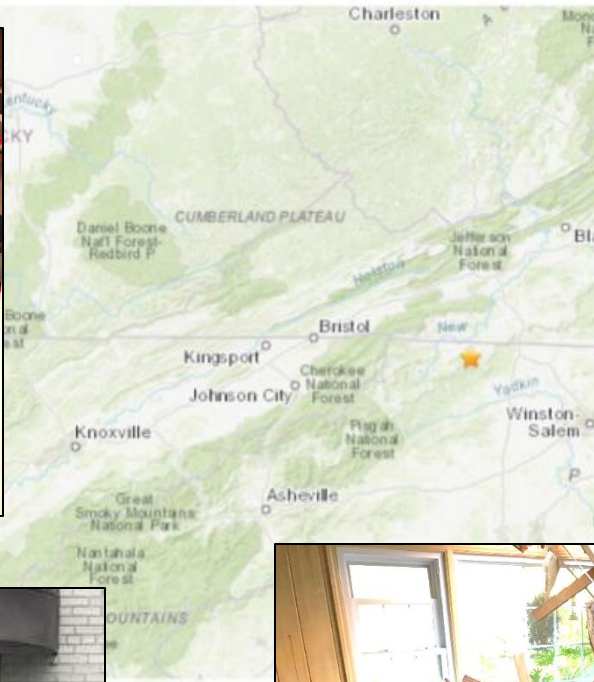


AUGUST 2020 – SPARTA EARTHQUAKE



M 5.1 – 3 km SE of Sparta, North Carolina

2020-08-09 12:07:37 (UTC) | 36.479°N 81.098°W | 9.2 km depth

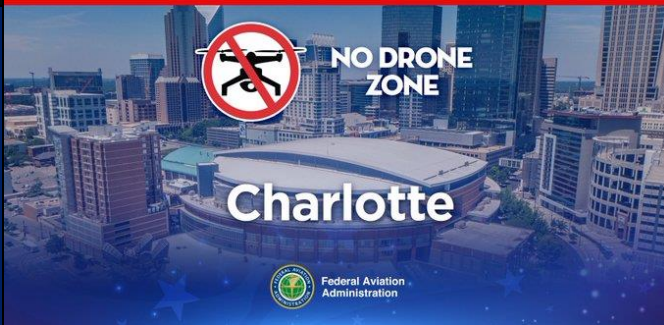


AUGUST 2020 – RNC IN CHARLOTTE

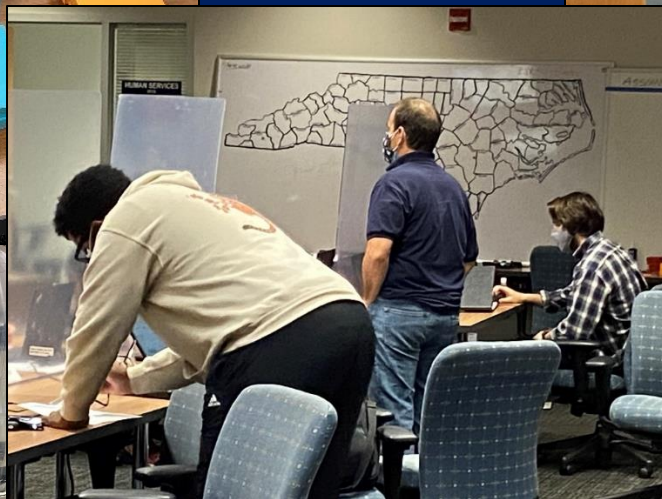
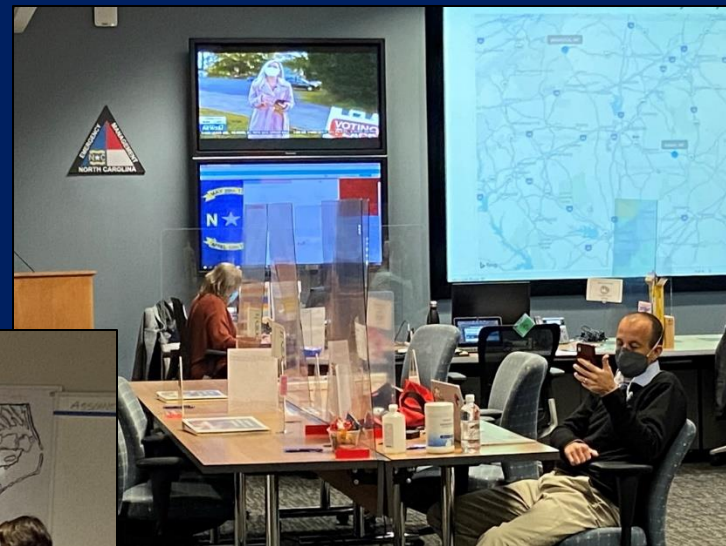


REPUBLICAN NATIONAL CONVENTION

AUG 24, 2020 | 6 AM to 4 PM



NOVEMBER 2020 – ELECTION DAY



NOVEMBER 2020 – TS ETA



An aerial photograph showing a residential area completely inundated with floodwater. Several houses and trees are visible, with water reaching up to the roofs of some structures. A large, semi-transparent blue circle is centered over the image, containing the title text.

Hurricane Season Outlook



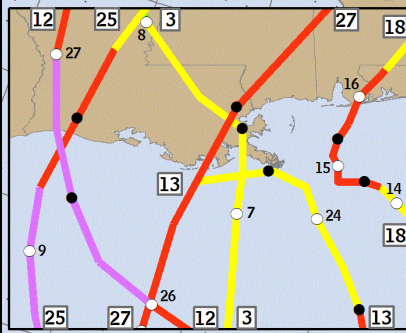
125° 120° 115° 110° 105° 100° 95° 90° 85° 80° 75° 70° 65° 60° 55° 50° 45° 40° 35° 30° 25° 20° 15° 10° 5° West 0° East

U.S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE NORTH ATLANTIC HURRICANE TRACKING CHART

PRELIMINARY

2020

NUMBER	WIND (kt)	TYPE	NAME	DATE
1	55	T	ARTHUR	MAY 16-21
2	45	T	BERTHA	MAY 27-28
3	50	T	CRISTOBAL	JUN 1-12
4	40	T	DOLLY	JUN 22-24
5	40	T	EDOUARD	JUL 4-7
6	50	T	FAY	JUL 9-11
7	55	T	GONZALO	JUL 21-25
8	75	H	HANNA	JUL 23-27
9	75	H	ISAIAS	JUL 30-AUG 5
10	40	T	JOSEPHINE	AUG 11-16
11	45	T	KYLE	AUG 14-16
12	130	MH	LAURA	AUG 20-28
13	65	H	MARCO	AUG 20-25
14	35	T	OMAR	AUG 31-SEP 5
15	65	H	NANA	SEP 1-4
16	90	H	PAULETTE	SEP 6-23
17	45	T	RENE	SEP 7-14
18	90	H	SALLY	SEP 11-17
19	120	MH	TEDDY	SEP 12-24
20	45	T	VICKY	SEP 14-17
21	50	T	BETA	SEP 17-22
22	35	T	WILFRED	SEP 18-21
23	55	T	ALPHA	SEP 14-18
24	60	T	GAMMA	OCT 2-6
25	120	MH	DELTA	OCT 5-10
26	100	MH	EPSILON	OCT 19-26
27	90	H	ZETA	OCT 24-29
28	130	MH	ETA	OCT 31-NOV 13
29	60	T	THETA	NOV 10-15
30	140	MH	IOTA	NOV 13-18



LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 250 500

- Major Hurricane
- Hurricane
- Tropical Storm
- Tropical Depression
- Subtropical Storm
- Subtropical Depression
- Wave/Low/Disturbance
- Extratropical
- Position at 0000 UTC
- Position/date at 1200 UTC
- Storm Number

HURRICANE SEASON 2020 RECAP



2020 Atlantic Hurricane Season by the numbers



13
Hurricanes
Average season
has six

7

6
Major
hurricanes
Average season
has three

12
Storms hit the
U.S. coastline,
(5 of which came
ashore in Louisiana)
Previous record: 9 in 1916

10
Named storms
that formed in
September
Most for any month on record

10
Rapidly intensifying
storms sampled
by NOAA and the
U.S. Air Force

30
Named storms

Arthur	Paulette
Bartha	Rene
Cristobal	Sally
Dolly	Teddy
Edouard	Vicky
Fay	Wilfred
Gonzalo	Alpha
Hanna	Beta
Isaias	Gamma
Josephine	Delta
Kyle	Epsilon
Laura	Zeta
Marco	Eta
Nana	Theta
Omar	Iota



NOAA Hurricane Hunters

86
Missions conducted

102
Hurricane eyewall passages

678
Flight hours

1,772
Dropsondes deployed
to gather vital atmospheric data



NOAA underwater
hurricane gliders

47
Glider deployments

13,272
Gathered observations

179,401
Temperature and
salinity profiles
These help improve forecasts for
current storms



16
NOAA weather
satellites in operation

5th
consecutive
above-normal season
Previous record: 4 from 1998 to 2001

86
Facebook Live
broadcasts
from the National Hurricane Center

2020 is now tied with 2005 for the most Atlantic major hurricanes
in a single season on record.

ATLANTIC HURRICANE SEASON



'Average' Atlantic Hurricane Season

*** Effective 2021**

1981-2010

**12 Named Storms
6 Hurricanes
3 Major Hurricanes**



1991-2020

**14 Named Storms
7 Hurricanes
3 Major Hurricanes**

* Numbers for an average season reflect the climate record for tropical storms and hurricanes and use the most recent 3 decades as the period of reference. More at: <http://bit.ly/NOAAHurricaneSeasonAverages>



Be prepared: Visit hurricanes.gov and follow @NWS and @NHC_Atlantic on Twitter.

Issued 4/9/21

HURRICANE SEASON 2021

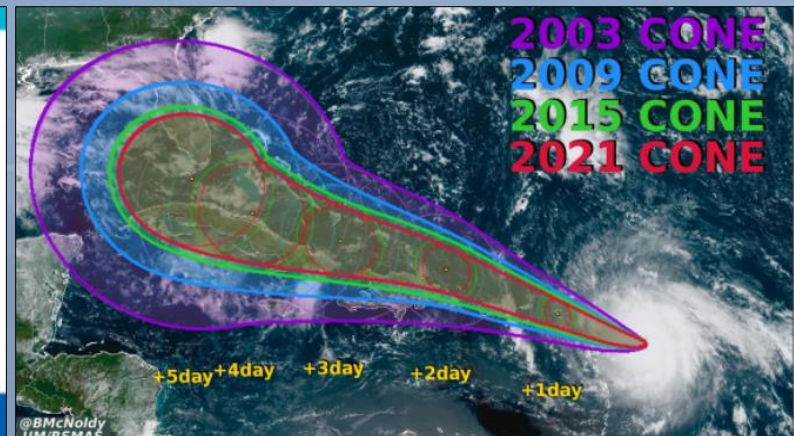


Upcoming Changes:

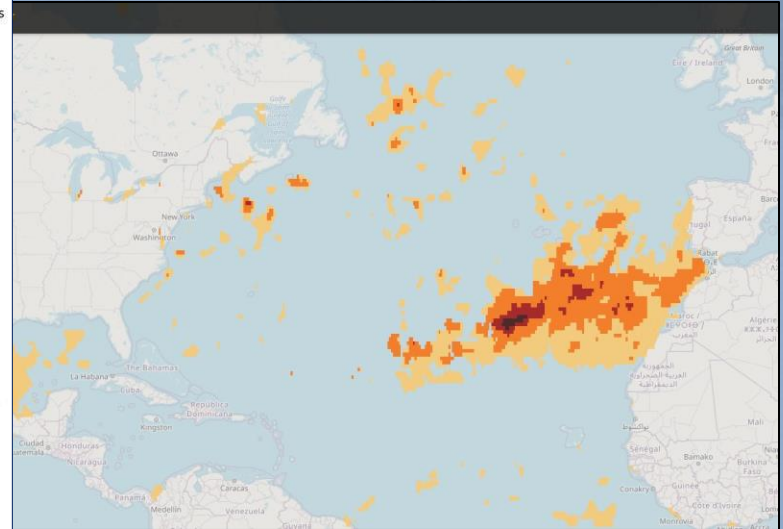
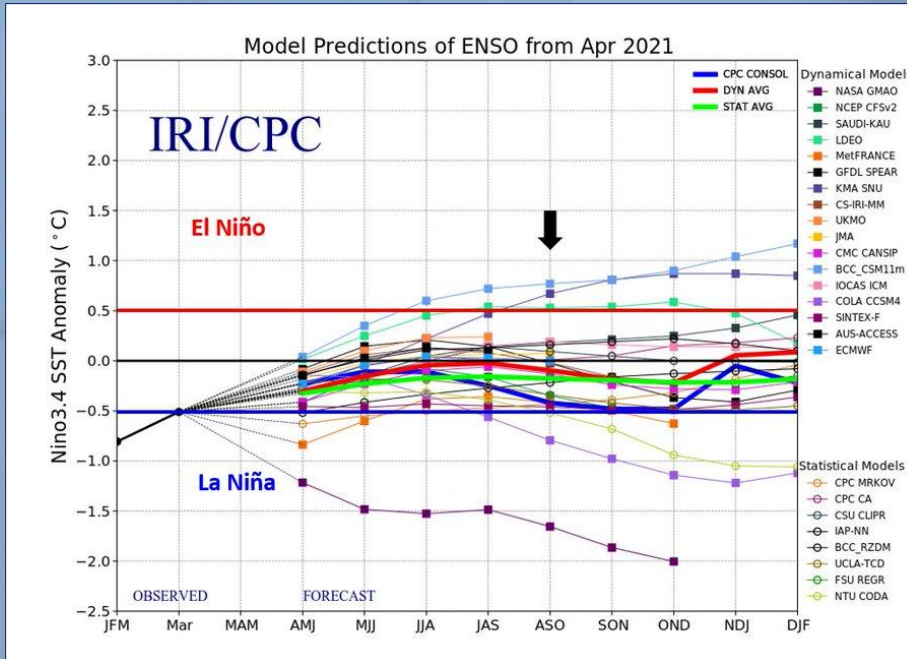
- Overflow name list no longer includes Greek Alphabet
- Four hurricane names were retired from the 2019-2020 seasons
 - Dorian replaced with Dexter (2025)
 - Laura replaced with Leah (2026)
- 2021 forecast cone will remain largely unchanged from previous seasons. Cone is now 35-40% smaller than in 2009.

Supplemental List of Atlantic Tropical Cyclone Season

Adria	Heath	Orlanda
Braylen	Isla	Pax
Caridad	Jacobus	Ronin
Deshawn	Kenzie	Sophie
Emery	Lucio	Tayshaun
Foster	Makayla	Viviana
Gemma	Nolan	Will



HURRICANE SEASON 2021



Most forecast models call for neutral ENSO conditions (e.g., neither El Niño nor La Niña) for the peak of the Atlantic hurricane season (August-October). El Niño generally increases vertical wind shear in the Atlantic, tearing apart hurricanes. Warmer than normal April subtropical Atlantic typically correlates with a more active Atlantic hurricane season.

NC KNOW YOUR ZONE



Do you Know Your Zone?

Twenty coastal counties have established predetermined evacuation zones to simplify the coastal evacuation process in the event of an emergency. Everyone living or vacationing in North Carolina's coastal areas should Know Your Zone.

Enter your address to find your zone →

KNOW YOUR ZONE



Frequently Asked Questions

Find answers to common questions regarding Know Your Zone



Evacuation Zone Posters

Download a poster of your county's evacuation zones



Digital Toolkit

Tools for local governments to use in Know Your Zone education



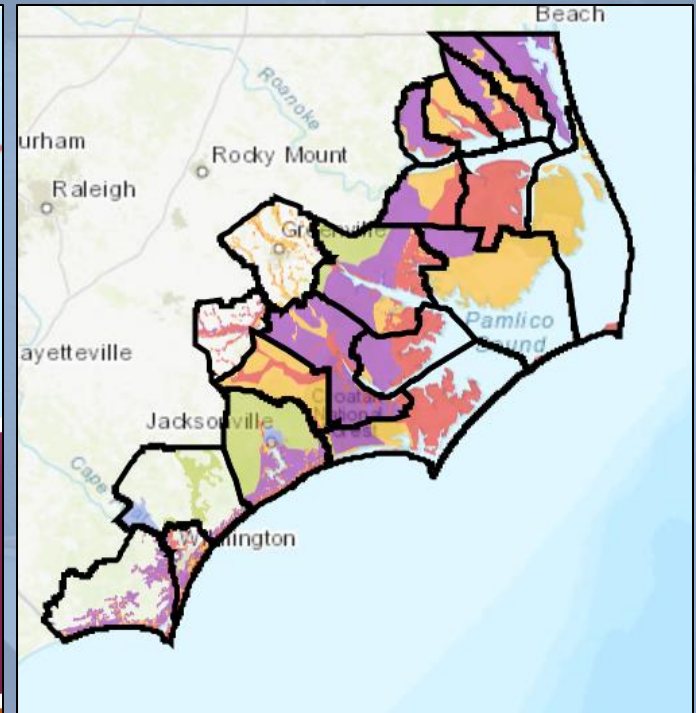
Hurricane Guide

Download your copy of the North Carolina Hurricane Guide



Evacuation Orders

When a storm threatens the North Carolina coast, see evacuation orders here.



KnowYourZone.NC.Gov

HURRICANE SEASON 2021



It only takes one!



NCCEM: Review of 2020 Hurricane Season Outlook

KATIE WEBSTER | ASSISTANT DIRECTOR
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Power Grid Resiliency Scenario Analysis

Dr. Robert Cox

Associate Director, EPIC

Robert.Cox@uncc.edu

May 19, 2021



UNC CHARLOTTE

Energy Production and Infrastructure Center

Project Background

- U.S. Dept. of Energy, State Energy Program Award
 - Project began in June 2019
- Building on & contributing to resilience-related efforts in NC & U.S.
 - 2023 Duke Energy (DE) Integrated Resource Plan, DE Grid Improvement Plan;
 - NCDEQ Clean Energy Plan & 2023 NC Hazard Mitigation Plan,
 - NARUC, NASEO, U.S. DOE Comprehensive Electricity Planning Task Force (through Feb 2021).
- Team



Resilience vs. Reliability

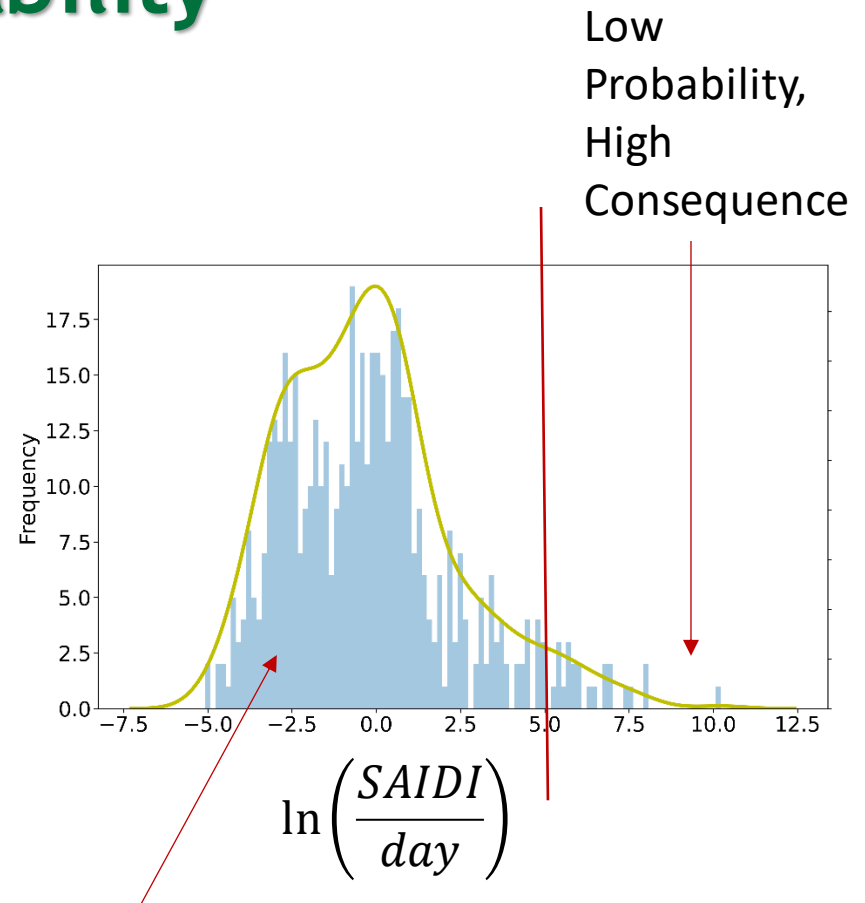
- Reliability:
 - Associated with everyday operation of the grid
 - Well defined metrics exist

System Average Interruption Duration Index (SAIDI)

$$= \frac{\text{Total Customer Outage Minutes}}{\text{Total Customers}}$$

Resilience vs. Reliability

- Reliability:
 - Associated with everyday operation of the grid
 - Well defined metrics exist
- Resiliency:
 - Associated with major events (i.e. hurricanes, ice storms, etc.)
 - No accepted metrics exist



High
Probability,
Low
Consequence

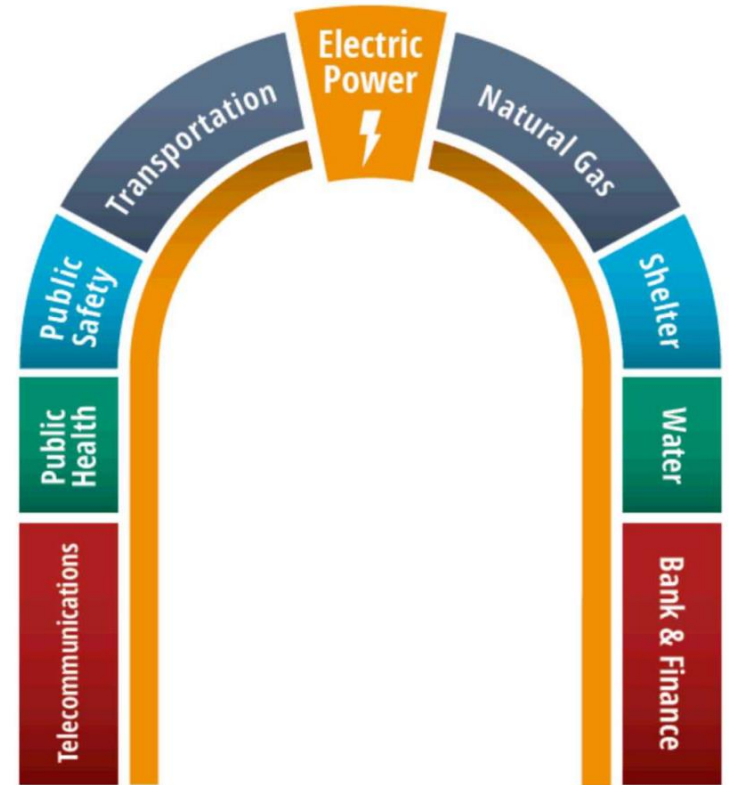
Understanding Resilience

- ‘Resilience’ means the ability to prepare for and adapt to changing conditions and ***withstand and recover rapidly*** from disruptions.
- Resilience is contextual:
Defined in terms of threats or hazards
 - Resilient to hurricane may not be resilient to earthquake
- Hazards have low probability but potential for high consequence

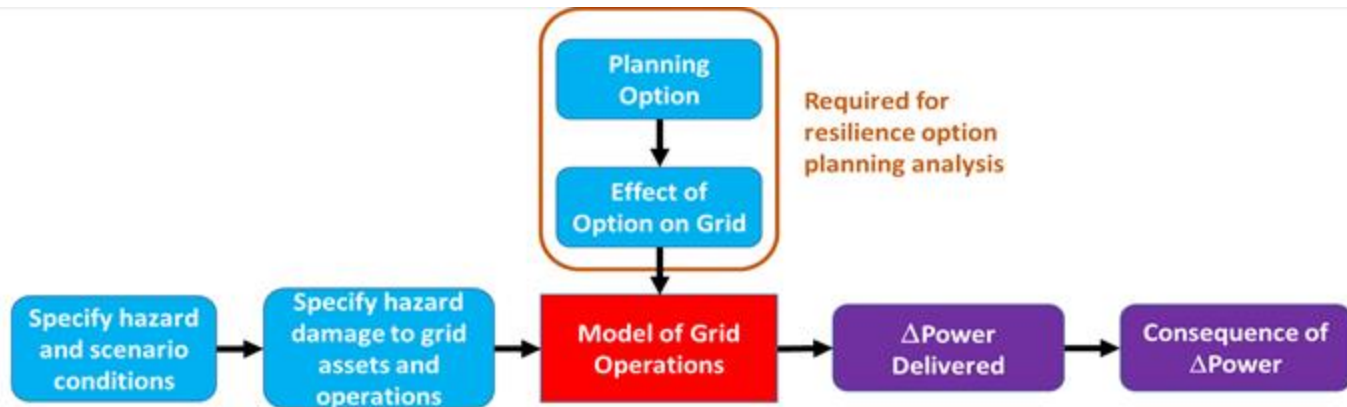


But Electric Power Can't Be Considered in Isolation...

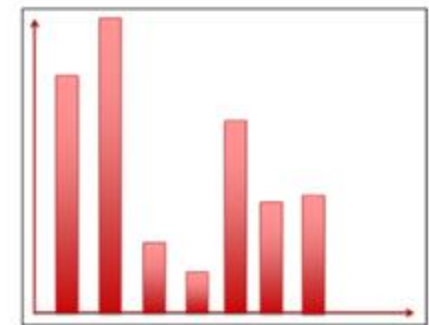
- Electric power is foundational to so many of the services that a community requires
- Resilience thus requires looking beyond simply the grid, but what the grid enables
- Utilities and communities/governments may see resilience differently



Approach



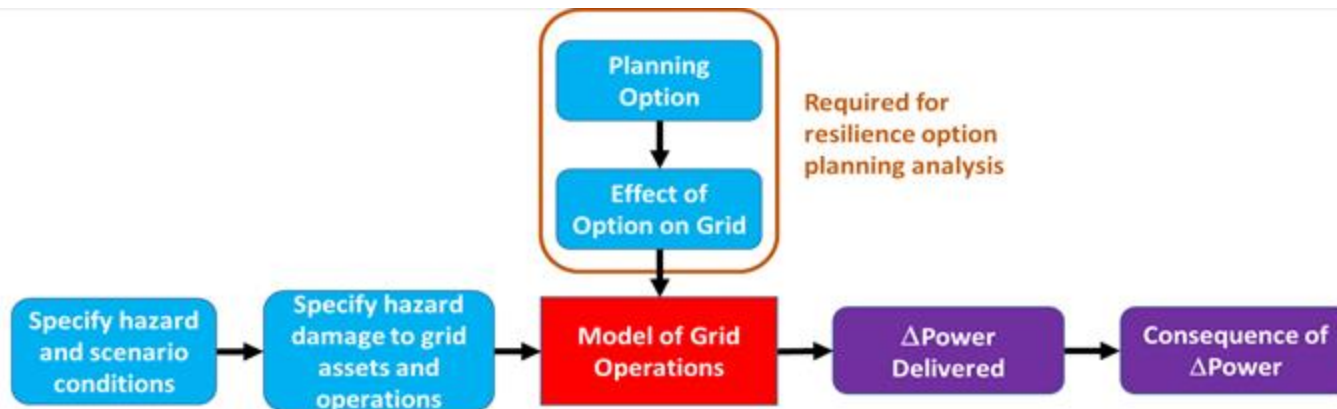
- Approach based on the Resilience Assessment Process (RAP) from Sandia National Laboratory



Histogram of Consequences

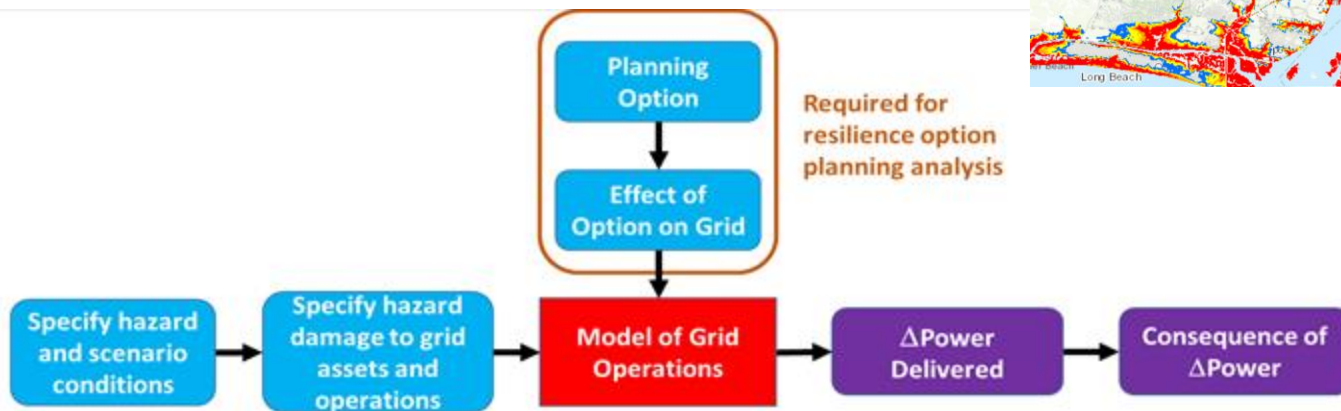
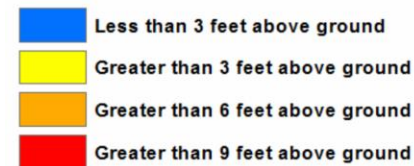
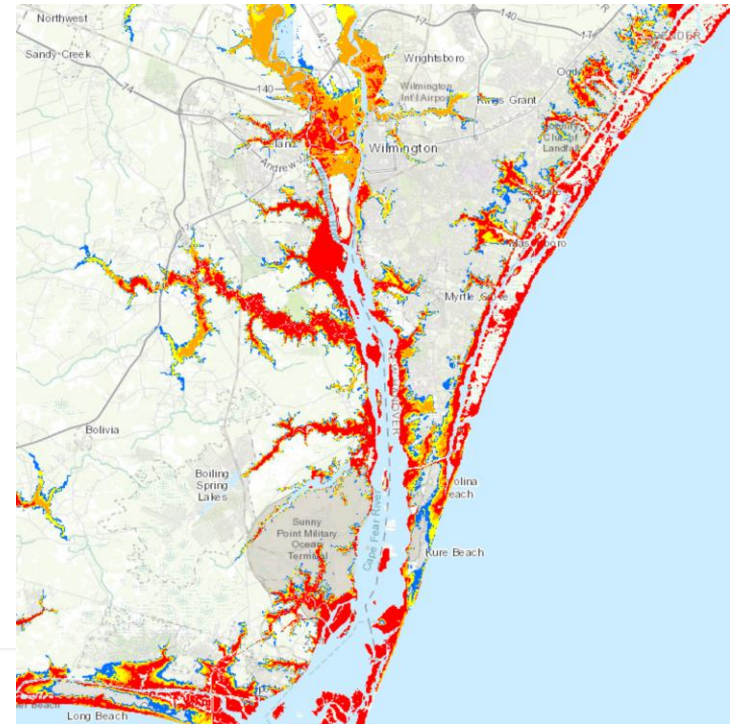
Defining Hazards

- Flooding / Inundation Threats
 - Risk to substations and distribution assets in different storm scenarios with and without SLR
 - Risk to diesel for onsite power
- Wind Threats
 - Risk to distribution assets in different storm scenarios
 - Relies on historic data

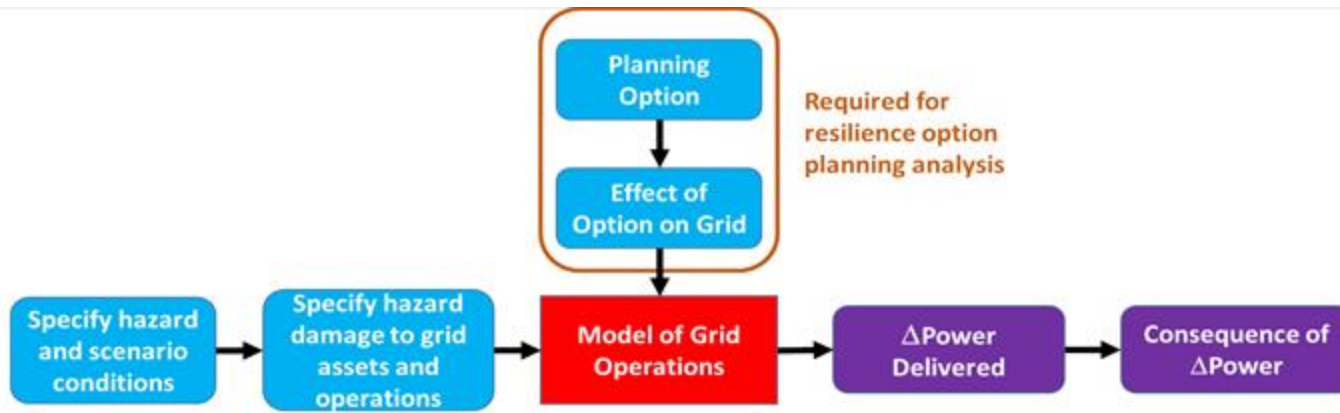


Example: Cat 2 Current Sea Levels

- Key infrastructure threats:
 - What substations are threatened?
 - What distribution circuits are threatened?
 - What threats are there to the transport network for backup fuel supply?



Example: Cat 2 Current Sea Levels

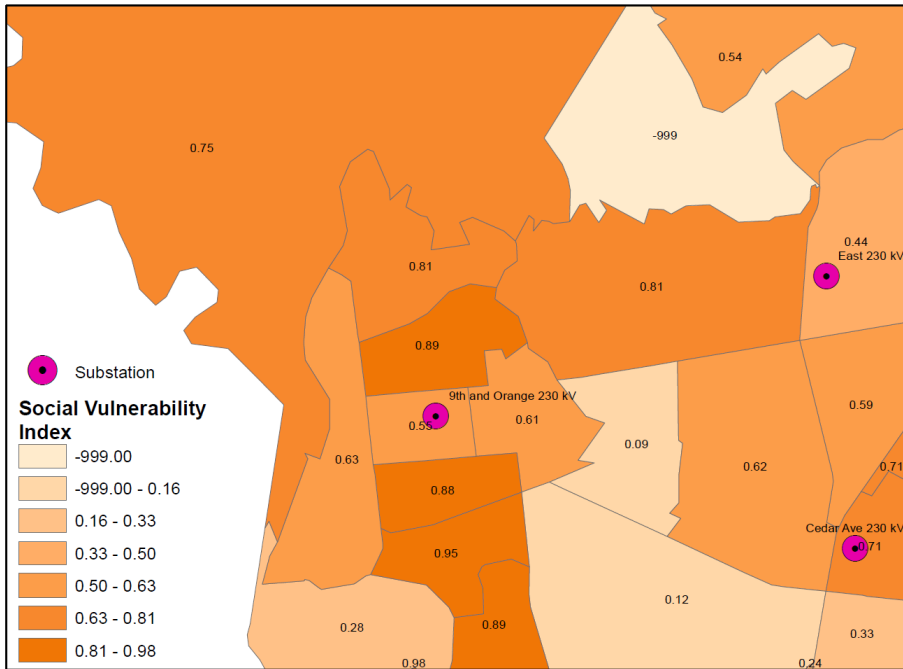


- How do we quantify consequences
 - What is the threat to the economy?
 - What is the threat to the community at large?
 - What is the impact on emergency management?

Example: Assessing Community Vulnerability

Storm (Year)	Date	SAIDI/Day
Hurricane Irene	August 2011	41.5 hours
2014 Ice Storm	February 2014	21.5 hours
Hurricane Michael	October 2016	14 hours
Hurricane Florence	September 2018	381 hours

Social Vulnerability Index

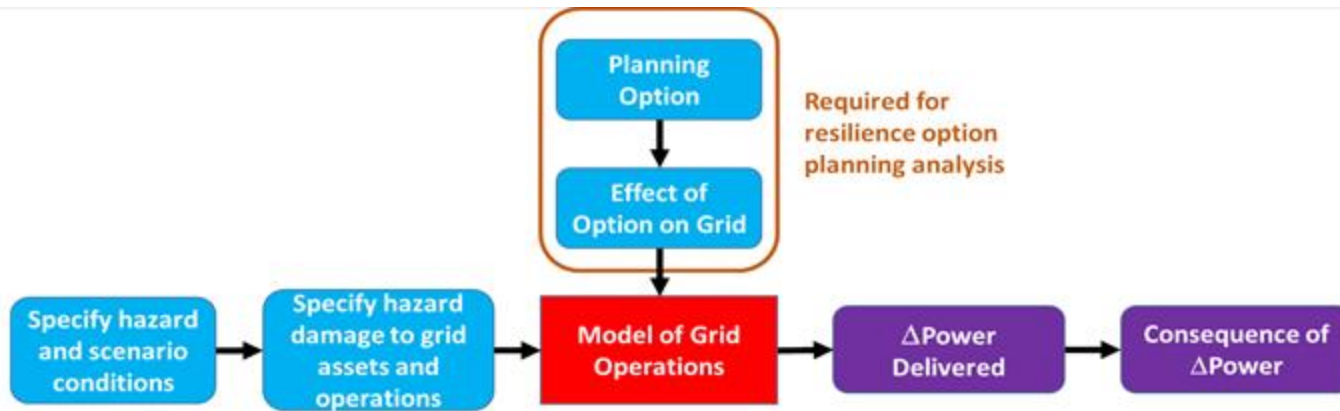


Distribution Circuits



How do we value resilience improvement in our most vulnerable areas?

Evaluating Planning Options



- Case 1: Value utility-proposed measures
 - Undergrounding
 - Self-Optimizing Grid
- Case 2: Value advanced solutions
 - Microgrid
 - Community resilience outposts

Contingent Valuation Approach for Utility Programs

Customer Benefits

Costs avoided for MED
Outage Reduction

Costs avoided for non-MED
Outage Reduction

Momentary outage cost
reduction

NEW: Valuation of community
& economic benefits

Scope

Costs &
Benefits

Costs & Benefits	Sources
Project Deployment Cost	Assumption of per mile installation cost based on prior work experience and future projections
Operational Savings - Veg Management Savings	Vegetation Management – Estimated based on double sided conventional chip costs/ vegetated backlot mile and demand trimming over 30 years
Operational Savings - Avoided Asset Management Costs	GIS – wire size <1/0 that would need to be included in small wire replacement program
Operational Savings - Avoided Outage Restoration Costs	OMS History – Outage events eliminated
Customer Savings - Avoided Momentary Interruption Costs	GIS – Circuits involved Customer Data Warehouse – Customer mix (Residential, <50,000kWh/year-Small & Medium C&I , >50,000kWh/year-Large C&I) on those circuits ICE Tool – information above used as input into ICE (Interruption Cost Estimator).
Customer Savings - Local Customer Avoided Outage Costs	Cost per customer event



Next Steps

- Valuing advanced approaches
 - Community outposts (Beth to address)
- Report development
 - Draft report available this summer
 - 3rd Stakeholder meeting this fall



Thank You!

Dr. Robert Cox

Associate Director, EPIC

Robert.Cox@uncc.edu

May 19, 2021



UNC CHARLOTTE

Energy Production and Infrastructure Center



Community Level Energy Resilience Planning

Beth Schrader

Director, NHC Office of Recovery and Resilience



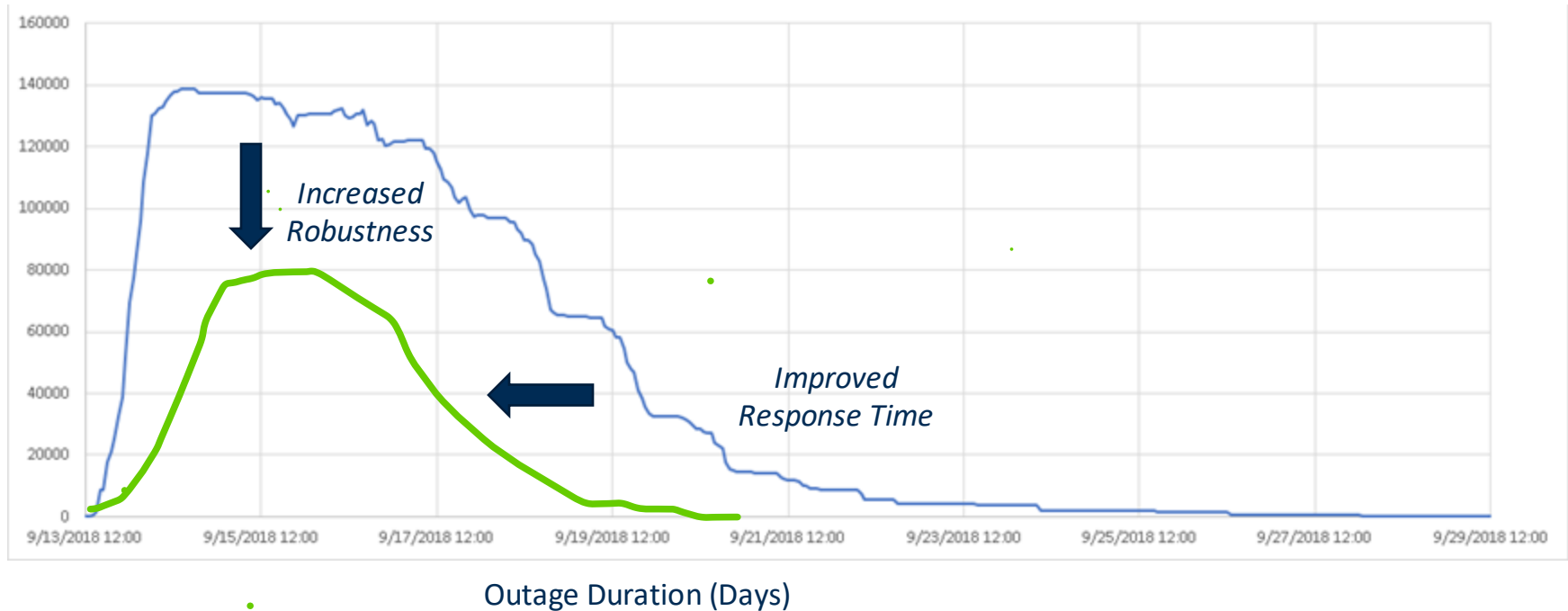
Dimensions of Community Resilience





Electric System Resilience

Customers without Power





Energy Resilience Planning

- Criticality of power
 - Independently
 - As an enabler to other systems
- Risks and vulnerabilities are continuous and discrete
- Resilience with an equity lens
- Identifying cost-effective ST-MT-LT interventions

Energy System

Reduce the number of customers impacted and duration of outages

Emergency Management

Efficiently address immediate life safety concerns

Reduce future losses, risks and vulnerabilities to life and property

Increase speed to recovery

Community Resilience

Trust, transparency, community input, and context

Improved health, economic and social well-being outcomes

Full participation, equitable access, availability, and benefit



Reframed Conversation About Resilience

Sequence & Layer

Strategies, funding, scope
and scale, cost / benefit

Interdependencies

Exist between systems and
across dimensions of resilience



(Un)usual Partners

Leveraging diverse partners
and those most impacted

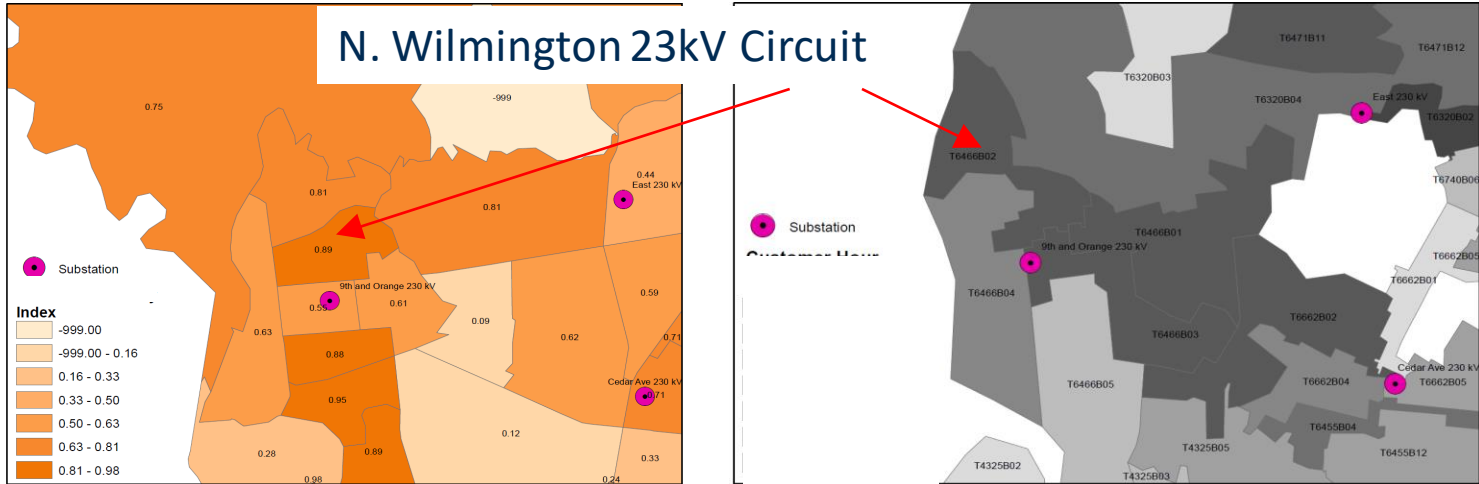
Disparate Impacts

Existing inequities magnify
direct and indirect impacts /
barriers



Aligning Vulnerability and Outages

Storm (Year)	Date	SAIDI
Hurricane Irene	August 2011	41.5 hours
2014 Ice Storm	February 2014	21.5 hours
Hurricane Michael	October 2016	14 hours
Hurricane Florence	September 2018	381 hours





Changing the Experience

CHALLENGES		OPPORTUNITIES
<ul style="list-style-type: none">Traditional / social media did not reach most impacted	Communication	<ul style="list-style-type: none">Leverage neighborhood networks and channelsCell phone re-charging stations
<ul style="list-style-type: none">Large % need shelter	Sheltering/ Displacement	<ul style="list-style-type: none">Available critical services = Lower % need shelter and/or shorter stays
<ul style="list-style-type: none">Large, centralized POD underutilizedHigh need pop. underserved	Commodity Distribution	<ul style="list-style-type: none">Smaller POD, open fewer days, paired with "Last Mile" distribution
<ul style="list-style-type: none">100% households experienced food loss	Food Loss	<ul style="list-style-type: none">Ice distribution before and after minimizes losses and DSNAP
<ul style="list-style-type: none">Multiple organizations / efforts2-3 meals / day for 28 days	Mass Feeding	<ul style="list-style-type: none">Local feeding, shorter duration; community re-connection



Range of Solutions

System-Level

- Reprioritization of 9th and Orange Street Substation
 - Existing project on approved CIP list
- Flood proofing vulnerable substations
- Continued roll out of self-healing technology
- Discontinue undergrounding project in area of buyouts

Community-Level

- Resilience Outposts - Locations with access to reliable on-site power
- Non-traditional, non-government partners
- Provide community-identified critical services
- Resiliency and preparedness outreach
- Enhancing impact of emergency management resources



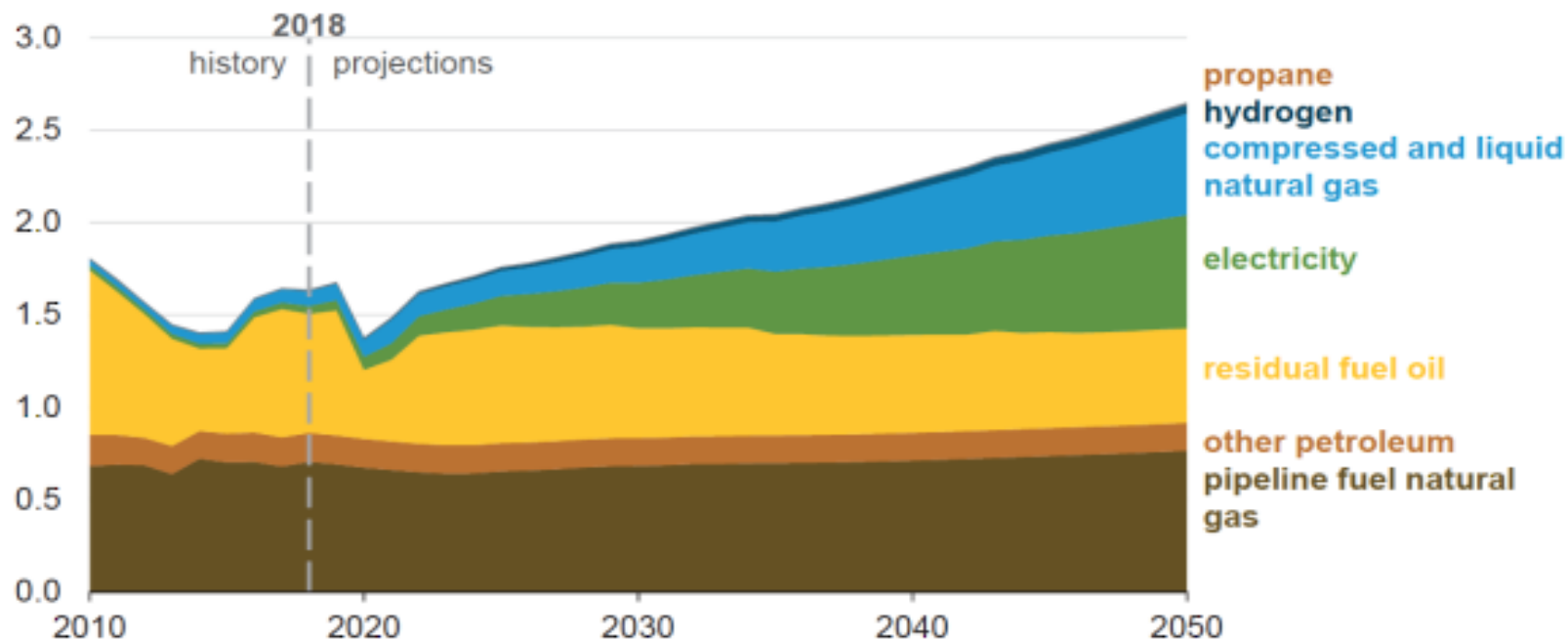
Carolina Alternative Fuel Infrastructure for Storm Resilience Plan

North Carolina Energy Policy Council
Wednesday, May 19, 2021



This presentation does not contain any proprietary, confidential, or otherwise restricted information.

Transportation sector consumption of minor petroleum and alternative fuels (Reference case) quadrillion British thermal units

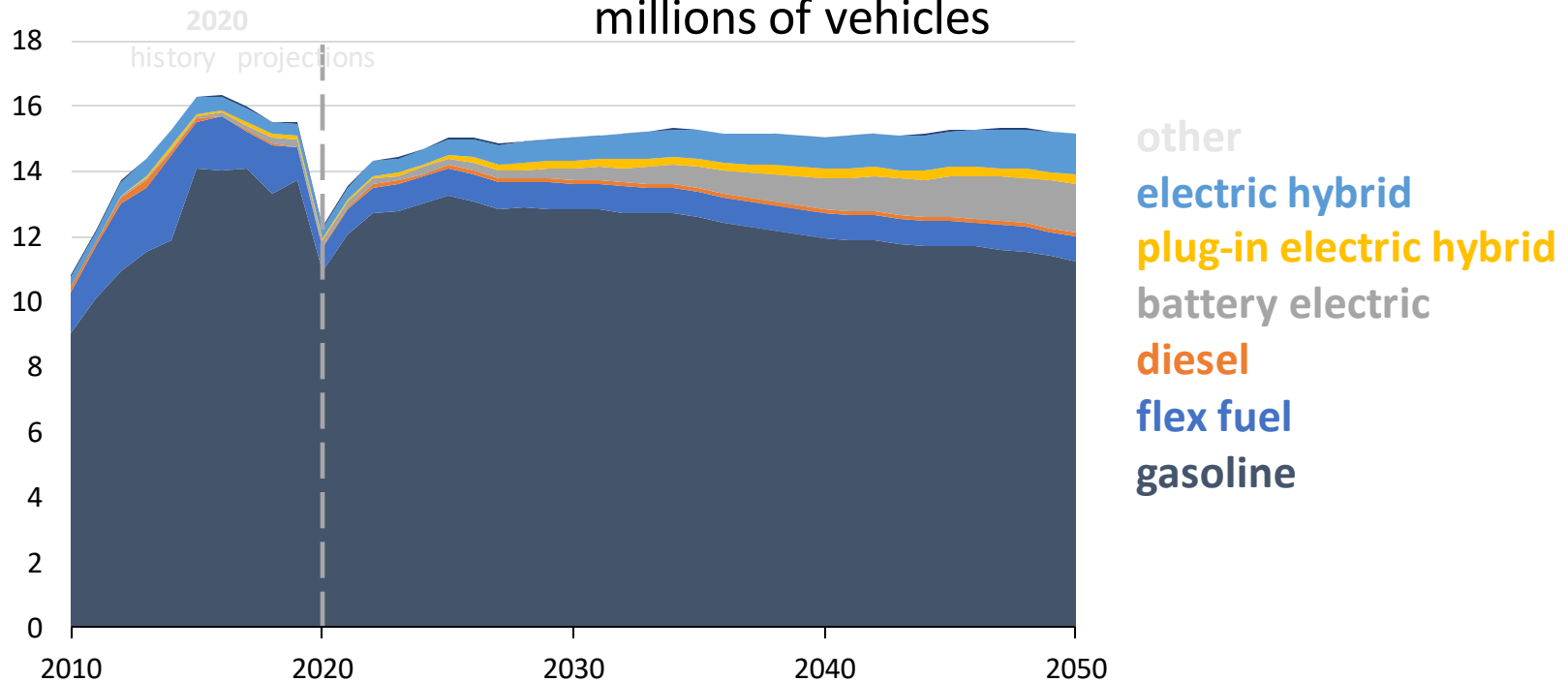


U.S. Energy Information Administration

#AEO2019

www.eia.gov/aeo

Light-duty vehicle sales by technology/fuel AEO2021 Reference case millions of vehicles



Statement of Project Objectives

Goals	Objectives	Impact
❖ Develop and implement the Carolina Alternative Fuel Infrastructure for Storm Resilience plan	❖ Complete research and compile inventories necessary for the project's planning phase;	❖ Create inventory of AFV infrastructure and fleets across North and South Carolina;
❖ Enhance Carolina alternative fuel vehicles fleet and fueling facility disaster preparedness, resiliency and recovery	❖ Complete assessments and create a draft plan; and	❖ Develop best practices during an emergency response;
❖ Increase alternate fuel use for emergency response fleets, utility restoration, and recovery operation services.	❖ Implement the plan through testing, validation, distribution, training, education and rehearsals.	❖ Data collection of AFV inventory and;
		❖ Post disaster emergency response plan that will impact infrastructure disruption, transportation, clean up, utility restoration and recovery operations.

Project Overview

Timeline: 10/1/19-12/31/2022

- ❖ Start Date: 10/1/19
- ❖ End Date: 12/31/22
- ❖ Completion: ~ 40%

Budget Period No.	Start Date	End Date	Federal Share minus FFRDC	Federal Share %	Non-Federal Share	Non-Federal Share %	FFRDC Share	Total Estimated Cost
1	10/1/2019	12/31/2020	\$186,940	35.4%	\$265,762	50.4%	\$75,000	\$527,702
2	1/1/2021	12/31/2021	\$194,686	34.4%	\$295,638	52.3%	\$75,000	\$565,324
3	1/1/2022	12/31/2022	\$219,943	37.3%	\$295,060	50.0%	\$75,000	\$590,003
Total Project			\$601,569	35.7%	\$856,460	50.9%	\$225,000	\$1,683,029

Barriers:

- ❖ EV inventory among emergency responders; and
- ❖ Limited availability of EV charging stations along evacuation routes.

Partners:

Grant Recipients

- ❖ E4 Carolinas
- ❖ Savannah River National Laboratory
- ❖ Southeast Alliance for Clean Energy (SACE)
- ❖ NC State University Clean Energy Technology Center
- ❖ Centralina Clean Fuels
- ❖ Triangle Clean Cities

Local Cost Share

- ❖ North Carolina Department of Environmental Quality (NCDEQ)
- ❖ ONEH2
- ❖ Dominion Energy South Carolina
- ❖ Duke Energy Piedmont Natural Gas
- ❖ Electric Cooperatives of South Carolina
- ❖ Advanced Energy

Project Approach

Budget Period 1 (2020): Complete research and compile inventories necessary for the project's planning phase.

Budget Period 2 (2021): Complete assessments and create a draft plan.

Budget Period 3 (2022): Implement the plan through testing, validation, distribution, training, education and rehearsals.

Collaboration and Coordination Among Project Team

- ❖ Monthly Subtask Leader/Co-Leader Meeting
- ❖ Monthly/Weekly Subtask Working Group Meetings
- ❖ Bi-Monthly GIS Meetings
- ❖ Quarterly Progress Reports
- ❖ Yearly Project Planning Meeting



Example of Project Activity and Findings

Task 1.2 – Inventory Creation (8/1 – 11/30/20):

Subtask 1.2.1 – Infrastructure Disruption: Organize an inventory depicting alternative fuel vehicle, utility and petroleum distribution infrastructure subject to disruption and requiring vehicle response.

Subtask 1.2.2 – Alternative Fuel Vehicle Infrastructure: Organize an inventory depicting the Carolinas' alternative fuel infrastructure, existing and planned alternative fuel vehicle fleets and conventional petroleum fuel resources.

- **Alternative Fuel**
 - ❖ Types of Vehicles
 - ❖ Infrastructure Requirements
 - ❖ Current vehicle and fleet distribution/ownership (e.g. Emergency Resources)
 - ❖ Distribution and Dispensing

Alternative Fueling Stations						
	BEV	HFC	NG	Propane	Biodiesel	Total
North Carolina						2,243
<i>Public</i>	1,610	0	27	66	6	
<i>Private</i>	312	0	15	9	108	
South Carolina						812
<i>Public</i>	568	1	8	53	0	
<i>Private</i>	84	0	5	6	34	

Source: 2020 <https://afdc.energy.gov/>

Project Status:

Achievements to Date:

- ❖ Produced alternative fuel vehicle inventory and creation of GIS database to store data;
- ❖ Transfer of knowledge and information between all Subtask Working Groups; and
- ❖ Strong collaborative relationships among all partners and stakeholders.

Upcoming:

- ❖ Collecting data and information regarding infrastructure disruption; and
- ❖ Working towards the plan creation among the Subtask Working Groups.

Types of Questions Plan Will Address

- ❖ Are alternative fuel vehicles appropriate for first responder and utility fleets?
- ❖ If so, what types and what portion of fleet should be alternative fuel?
- ❖ How will alternative fuels be supplied when infrastructure is disrupted?
- ❖ Can fuel be dispensed when power, natural gas and communications (Internet) is disrupted?
- ❖ Will evacuation route alternative fuel resources to support evacuation?
- ❖ How will future demand for alternative fuel resources change?



Carolina Alternative Fuel Infrastructure for Storm Resilience Plan

North Carolina Energy Policy Council
Wednesday, May 19, 2021

THANK YOU!